

WHAT IS CLAIMED IS:

1. An exhaust manifold comprising a ceramic inner layer defining an exhaust gas passageway, a composite insulation zone disposed exterior to and adjacent said inner layer, and an outer structural layer disposed exterior to said composite insulation zone, said composite insulation zone comprising at least one metallic foil layer.

2. An exhaust manifold according to claim 1, said composite insulation zone comprising a plurality of said metallic foil layers and at least one ceramic insulating layer disposed between adjacent ones of said metallic foil layers.

3. An exhaust manifold according to claim 1, said composite insulation zone comprising a plurality of said metallic foil layers and at least one substantially evacuated annular space disposed between adjacent ones of said metallic foil layers.

4. An exhaust manifold according to claim 1, said composite insulation zone comprising a plurality of said metallic foil layers and at least one microsphere layer disposed between adjacent ones of said metallic foil layers.

5. An exhaust manifold according to claim 1, further comprising a strain isolation layer disposed between said composite insulation zone and said outer structural layer.

6. An exhaust manifold according to claim 5, said strain isolation layer being an intumescent mat.

7. An exhaust manifold according to claim 6, said intumescent mat comprising, by weight, 20-60 percent ceramic fibers, and 35-75 percent expandable material.

8. An exhaust manifold according to claim 7, said expandable material being vermiculite, perlite, or a mixture thereof.

9. An exhaust manifold according to claim 7, said intumescent mat further comprising an organic binder material effective to bind said ceramic fibers together to provide a coherent fibrous mat.

10. An exhaust manifold according to claim 6, said intumescent mat exhibiting the property of expanding on heating of said mat, and contracting on cooling thereof.

11. An exhaust manifold according to claim 6, said intumescent mat having a crossover temperature below which said mat exhibits the property of expanding on heating and contracting on cooling, and above which said mat no longer exhibits the property of contracting on cooling.

12. An exhaust manifold according to claim 1, wherein said inner layer is 0.05-10 mm thick, said composite insulation zone is 1-40 mm thick and said outer layer is 1-25 mm thick.

13. An exhaust manifold according to claim 1, wherein said inner layer comprises a catalyst effective to convert at least a portion of CO and NO_x in an exhaust gas flowing through said exhaust passageway to CO₂, and N₂ and O₂ respectively.

14. An exhaust manifold according to claim 13, wherein said catalyst has the form ABO_z and is selected from the group consisting of a) a perovskite catalyst, wherein A is a rare earth element and an alkaline earth element, and B is a transition metal element; and b) a fluorite catalyst, wherein A is a rare earth element and B is Ce or Zr.

15. An exhaust manifold according to claim 14, said catalyst being a perovskite metal oxide catalyst, wherein A is lanthanum and strontium, and B is selected from the group consisting of iron, cobalt, manganese, titanium, gallium, chromium, and nickel.

16. An exhaust manifold according to claim 14, said catalyst being a fluorite metal oxide catalyst, wherein A is a rare earth element, B is either Ce or Zr.

17. An exhaust manifold comprising a ceramic inner layer defining an exhaust gas passageway, an outer structural layer disposed exterior to said ceramic inner layer, and a strain isolation layer disposed intermediate said ceramic inner layer and said outer structural layer, said strain isolation layer comprising an intumescent mat.

18. An exhaust manifold according to claim 17, said intumescent mat comprising, by

weight, 20-60 percent ceramic fibers, and 35-75 percent expandable material.

19. An intumescent mat according to claim 18, said expandable material being vermiculite, perlite, or a mixture thereof.

20. An exhaust manifold according to claim 18, said intumescent mat further comprising an organic binder material effective to bind said ceramic fibers together to provide a coherent fibrous mat.

21. An exhaust manifold according to claim 18, said intumescent mat exhibiting the property of expanding on heating of said mat, and contracting on cooling thereof.

22. An exhaust manifold according to claim 17, said intumescent mat having a crossover temperature below which said mat exhibits the property of expanding on heating and contracting on cooling, and above which said mat no longer exhibits the property of contracting on cooling.

23. An exhaust manifold according to claim 1, said manifold having a main tube portion and at least one runner extending from said main tube portion with an inlet port located at a terminal end of the runner, wherein the layers and the composite insulation zone described in claim 1 are provided in the main tube portion of the manifold,

the runner comprising a ceramic inner layer that is substantially encased within and spaced apart from a metallic outer layer thereof, said ceramic inner layer defining an exhaust gas passageway therein for conducting exhaust gas from said inlet port toward and into said main tube portion of said manifold,

wherein a sealing gasket is disposed and compressed between said ceramic inner and metallic outer layers of the runner at or adjacent the terminal end thereof, said sealing gasket being shielded by the metallic outer layer.

24. An exhaust manifold according to claim 23:

said metallic outer layer of said runner comprising a metallic extruded portion that extends from the main tube portion of the manifold, and an inwardly extending flange portion located at the terminal end of the metallic extruded portion,

said ceramic inner layer of said runner having an extruded configuration and

extending from the main tube portion of the manifold, wherein the ceramic extruded layer approaches but does not contact the flange portion of the metallic outer layer of the runner, leaving a small gap between a terminal end of the ceramic extruded layer of the runner and the flange portion,

said sealing gasket being at least partially expanded in the gap between the terminal end of the ceramic extruded layer and the flange portion of the metallic outer layer, thereby shielding the terminal edge of the ceramic extruded layer from direct contact with said flange portion.

25. An exhaust manifold having a main tube portion and at least one runner extending from said main tube portion and having an inlet port located at a terminal end of the runner, the runner comprising a ceramic inner layer that is substantially encased within and spaced apart from a metallic outer layer, said ceramic inner layer defining an exhaust gas passageway therein for conducting exhaust gas from said inlet port toward and into said main tube portion of said manifold,

wherein a sealing gasket is disposed and compressed between said ceramic inner and metallic outer layers at or adjacent the terminal end of said runner, said sealing gasket being shielded by the metallic outer layer.

26. An exhaust manifold according to claim 25:

said metallic outer layer of said runner comprising a metallic extruded portion that extends from the main tube portion of the manifold, and an inwardly extending flange portion located at the terminal end of the metallic extruded portion,

said ceramic inner layer of said runner having an extruded configuration and extending from the main tube portion of the manifold, wherein the ceramic extruded layer approaches but does not contact the flange portion of the metallic outer layer of the runner, leaving a small gap between a terminal end of the ceramic extruded layer of the runner and the flange portion,

said sealing gasket being at least partially expanded in the gap between the terminal end of the ceramic extruded layer and the flange portion of the metallic outer layer, thereby shielding the terminal edge of the ceramic extruded layer from direct contact with said flange portion.

27. An exhaust manifold comprising a ceramic inner layer encased within and spaced

apart from a metallic outer layer thus defining an annular space therebetween, said manifold having a main tube portion and at least one runner extending from said main tube portion,

wherein at least one O-ring gasket is provided and compressed in said annular space at a location in said main tube portion of said exhaust manifold.

28. An exhaust manifold according to claim 27, said ceramic inner layer comprising a ceramic main tube portion and a ceramic extruded portion that extends from and is in fluid communication with said ceramic main tube portion, said ceramic extruded portion defining an exhaust gas passageway therein for said at least one runner,

said metallic outer layer comprising a metallic main tube portion and a metallic extruded portion that extends from said metallic main tube portion, said metallic extruded portion substantially enclosing said ceramic extruded portion therein, thereby forming said at least one runner extending from said main tube portion of said manifold,

wherein said at least one O-ring gasket is located in said main tube portion adjacent said at least one runner.

29. An exhaust manifold according to claim 28, comprising a pair of O-ring gaskets located in said main tube portion adjacent opposite sides of said at least one runner.